AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Original) An apparatus for retrieving face images using combined component descriptors, comprising:

an image division unit for dividing an input image into facial components;

a Linear Discriminant Analysis (LDA) transformation unit for LDA transforming the divided facial components into component descriptors of the facial components;

a vector synthesis unit for synthesizing the transformed component descriptors into a single vector;

a Generalized Discriminant Analysis (GDA) transformation unit for GDA transforming the single vector into a single face descriptor; and

a similarity determination unit for determining similarities between an input query face image and face images stored in an face image database (DB) by comparing a face descriptor of the input query face image with face descriptors of the face images stored in the face image DB.

2. (Original) The apparatus as set forth in claim 1, wherein the LDA transformation unit comprises:

LDA transformation units for LDA transforming the divided facial components into component descriptors of the facial components; and

vector normalization units for vector normalizing the transformed component descriptors into a one-dimensional vector.

3. (Original) The apparatus as set forth in claim 2, wherein the LDA transformation units and vector normalization units are each provided for the divided facial components.

4. (Original) The apparatus as set forth in claim 1, further comprising a transformation matrix/transformation coefficient DB for storing a transformation matrix or transformation coefficients calculated by training the face images stored in the image DB,

wherein the LDA transformation unit or the GDA transformation unit performs LDA transformation or GDA transformation using the stored transformation matrix or transformation coefficients.

5. (Original) The apparatus as set forth in claim 1, wherein: the image DB stores face descriptors of the face images; and the comparing of the input query face image with the face images of the image DB is performed by comparing the face descriptor of the input query face image with the face descriptors of the face images stored in the image DB.

6. (Original) The apparatus as set forth in claim 1, wherein the divided face components are partially overlapped with each other.

7. (Original) The apparatus as set forth in claim 1, wherein the face components into which the input face image is divided comprises eyes, a nose and a mouth.

8. (Original) The apparatus as set forth in claim 1, wherein the similarity determination unit extracts first similar face images similar to the input query face image and second similar face images similar to the first face images from the image DB, and determines similarities

between the input query face image and the face images of the image DB using the similarities between the input query face image and the second similar face images.

9. (Original) The apparatus as set forth in claim 8, wherein the determination of the similarities between the input query face image and the face images of the image DB is performed using the following equation

$$\text{Joint } S_{q,m} = S_{q,m} + \sum_{k=1}^{M} S_{q,h^{1st}k} \cdot S_{h^{1st}k,m} + \sum_{k=1}^{M} S_{q,h^{1st}k} \sum_{l=1}^{L} S_{h^{1st}k,h^{2nd}l} \cdot S_{h^{2nd}l,m}$$

where $S_{q,m}$ denotes similarities between the input query face image q and the face images m of the image DB, $S_{q,h}{}^{1st}{}_{k}$ denotes similarities between the query face image q and the first similar face images, $S_{h}{}^{1st}{}_{k,m}$ denotes similarities between the first similar face images and the face images m of the image DB, $S_{h}{}^{1st}{}_{k,h}{}^{2nd}{}_{l}$ denotes similarities between the first similar face images and the second similar face images, $S_{h}{}^{2nd}{}_{l,m}$ denotes similarities between the second similar face images and the face images m of the image DB, M denotes a number of the first similar face images, and L denotes a number of the second similar face images with respect to each of the second similar face images.

10. (Original) An apparatus for retrieving face images using combined component descriptors, comprising:

an image division unit for dividing an input image into facial components;

a first LDA transformation unit for LDA transforming the divided facial components into component descriptors of the facial components;

a vector synthesis unit for synthesizing the transformed component descriptors into a single vector;

a second LDA transformation unit for LDA transforming the single vector into a single face descriptor; and

a similarity determination unit for determining similarities between an input query face image and face images stored in an face image database (DB) by comparing a face descriptor of the input query face image with face descriptors of the face images stored in the face image DB.

11. (Original) The apparatus as set forth in claim 10, wherein the first LDA transformation unit comprises:

LDA transformation units for LDA transforming the divided facial components into component descriptors of the facial components; and

vector normalization units for vector normalizing the transformed component descriptors into a one-dimensional vector.

12. (Original) The apparatus as set forth in claim 11, wherein the LDA transformation units and vector normalization units are each provided for the divided facial components.

13. (Previously Presented) The apparatus as set forth in claim 10, further comprising a transformation matrix/transformation coefficient DB for storing a transformation matrix or transformation coefficients calculated by training the face images stored in the image DB,

wherein the first LDA transformation unit or the second LDA transformation unit performs LDA transformation using the stored transformation matrix or transformation coefficients.

14. (Original) The apparatus as set forth in claim 10, wherein:

the image DB stores face descriptors of the face images; and

the comparing of the input query face image with the face images of the image DB is performed by comparing the face descriptor of the input query face image with the face descriptors of the face images stored in the image DB.

15. (Original) The apparatus as set forth in claim 10, wherein the divided face components are partially overlapped with each other.

16. (Original) The apparatus as set forth in claim 10, wherein the face components into which the input face image is divided comprises eyes, a nose and a mouth.

17. (Original) The apparatus as set forth in claim 10, wherein the similarity determination unit extracts first similar face images similar to the input query face image and second similar face images similar to the first face images from the image DB, and determines similarities between the input query face image and the face images of the image DB using the similarities between the input query face image and the second similar face images.

18. (Previously Presented) The apparatus as set forth in claim 17, wherein the determination of the similarities between the input query face image and the face images of the image DB is performed using the following equation

$$\text{Joint } S_{q,m} = S_{q,m} + \sum_{k=1}^{M} S_{q,h^{1st}k} \cdot S_{h^{1st}k,m} + \sum_{k=1}^{M} S_{q,h^{1st}k} \sum_{l=1}^{L} S_{h^{1st}k,h^{2nd}l} \cdot S_{h^{2nd}l,m}$$

where $S_{q,m}$ denotes similarities between the input query face image q and the face images m of the image DB, $S_{q,h}{}^{1st}{}_{k}$ denotes similarities between the query face image q and

the first similar face images, $S_h{}^{1st}{}_{k,m}$ denotes similarities between the first similar face images and the face images m of the image DB, $S_h{}^{1st}{}_{k,h}{}^{2nd}{}_{l}$ denotes similarities between the first similar face images and the second similar face images, $S_h{}^{2nd}{}_{l,m}$ denotes similarities between the second similar face images and the face images m of the image DB, M denotes a number of the first similar face images, and L denotes a number of the second similar face images with respect to each of the second similar face images.

19. (Original) A method of retrieving face images using combined component descriptors, comprising the steps of:

dividing an input image into facial components;

LDA transforming the divided facial components into component descriptors of the facial components;

synthesizing the transformed component descriptors into a single vector;

GDA transforming the single vector into a single face descriptor; and

determining similarities between an input query face image and face images stored in a face image DB by comparing a face descriptor of the input query face image with face descriptors of the face images stored in the face image DB.

20. (Original) The method as set forth in claim 19, wherein the step of LDA transforming the divided facial components comprises the steps of:

LDA transforming the divided facial components into component descriptors of the facial components; and

vector normalizing the transformed component descriptors into a one-dimensional vector.

21. (Original) The method as set forth in claim 19, wherein the LDA transforming or the GDA transforming is carried out using a transformation matrix or a transformation coefficient calculated by training the face images stored in the image DB.

22. (Original) The method as set forth in claim 19, further comprising the step of outputting the face images of the image DB retrieved based on the determined similarities.

23. (Original) The method as set forth in claim 19, wherein the comparing of the input query face image with the face images of the image DB is performed by comparing the face descriptor of the input query face image with the face descriptors of the face images stored in the image DB.

24. (Original) The method as set forth in claim 19, wherein the divided face components are partially overlapped with each other.

25. (Original) The method as set forth in claim 19, wherein the face components into which the input face image is divided comprises eyes, a nose and a mouth.

26. (Previously Presented) The method as set forth in claim 19, wherein the step of determining similarities comprises the steps of:

extracting first similar face images similar to the input query face image from the image DB;

extracting second similar face images similar to the first face images from the image DB; and

determining similarities between the input query face image and the face images of the image DB using the similarities between the input query face image and the second similar face images.

27. (Currently Amended) The method as set forth in claim 19, wherein the step of determining similarities comprises:

a first similarity determination step of determining similarities between the input query face image and the face images of the image DB;

a first similar face image extraction step of extracting [[the]] first similar face images in an order of similarities according to results of the first similarity determination step;

a second similarity determination step of determining similarities between the first similar face images and the face images of the image DB; and

a second similar face image extraction step of extracting [[the]] second similar face images for each of the first similar face images in an order of similarities according to results of the second similarity determination step.

28. (Previously Presented) The method as set forth in claim 26, wherein the determining of similarities between the input query face image and the face images of the image DB is performed using the following equation

$$\text{Joint } S_{q,m} = S_{q,m} + \sum_{k=1}^{M} S_{q,h^{1st}k} \cdot S_{h^{1st}k,m} + \sum_{k=1}^{M} S_{q,h^{1st}k} \sum_{l=1}^{L} S_{h^{1st}k,h^{2nd}l} \cdot S_{h^{2nd}l,m}$$

where $S_{q,m}$ denotes similarities between the input query face image q and the face images m of the image DB, $S_{q,h}{}^{1st}{}_{k}$ denotes similarities between the query face image q and the first similar face images, $Sh^{1st}{}_{k,m}$ denotes similarities between the first similar face images and the face images m of the image DB, $S_{h}{}^{1st}{}_{k,h}{}^{2nd}{}_{l}$ denotes similarities between the first

similar face images and the second similar face images, $S_h^{2nd}{}_{l,m}$ denotes similarities between the second similar face images and the face images m of the image DB, M denotes a number of the first similar face images, and L denotes a number of the second similar face images with respect to each of the second similar face images.

29. (Original) A method of retrieving face images using combined component descriptors, comprising the steps of:

dividing an input image into facial components;

LDA transforming the divided facial components into component descriptors of the facial components;

synthesizing the transformed component descriptors into a single vector;

LDA transforming the single vector into a single face descriptor; and

determining similarities between an input query face image and face images stored in a face image DB by comparing a face descriptor of the input query face image with face descriptors of the face images stored in the face image DB.

30. (Original) The method as set forth in claim 29, wherein the step of LDA transforming the divided facial components comprises the steps of:

LDA transforming the divided facial components into component descriptors of the facial components; and

vector normalizing the transformed component descriptors into a one-dimensional vector.

31. (Original) The method as set forth in claim 29, wherein the LDA transforming is carried out using a transformation matrix or a transformation coefficient calculated by training the face images stored in the image DB.

32. (Original) The method as set forth in claim 29, further comprising the step of outputting the face images of the image DB retrieved based on the determined similarities.

33. (Original) The method as set forth in claim 29, wherein the comparing of the input query face image with the face images of the image DB is performed by comparing the face descriptor of the input query face image with the face descriptors of the face images stored in the image DB.

34. (Original) The method as set forth in claim 29, wherein the divided face components are partially overlapped with each other.

35. (Original) The method as set forth in claim 29, wherein the face components into which the input face image is divided comprises eyes, a nose and a mouth.

36. (Previously Presented) The method as set forth in claim 29, wherein the step of determining similarities comprises the steps of:

extracting first similar face images similar to the input query face image from the image DB;

extracting second similar face images similar to the first face images from the image DB; and

determining similarities between the input query face image and the face images of the image DB using the similarities between the input query face image and the second similar face images.

37. (Currently Amended) The method as set forth in claim 29, wherein the step of determining similarities comprises:

a first similarity determination step of determining similarities between the input query face image and the face images of the image DB;

a first similar face image extraction step of extracting [[the]] first similar face images in an order of similarities according to results of the first similarity determination step;

a second similarity determination step of determining similarities between the first similar face images and the face images of the image DB; and

a second similar face image extraction step of extracting [[the]] second similar face images for each of the first similar face images in an order of similarities according to results of the second similarity determination step.

38. (Previously Presented) The method as set forth in claim 36, wherein the determining of similarities between the input query face image and the face images of the image DB is performed using the following equation

$$\text{Joint } S_{q,m} = S_{q,m} + \sum_{k=1}^{M} S_{q,h^{1st}k} \cdot S_{h^{1st}k,m} + \sum_{k=1}^{M} S_{q,h^{1st}k} \sum_{l=1}^{L} S_{h^{1st}k,h^{2nd}l} \cdot S_{h^{2nd}l,m}$$

where $S_{q,m}$ denotes similarities between the input query face image q and the face images m of the image DB, $S_{q,h}{}^{1st}{}_{k}$ denotes similarities between the query face image q and the first similar face images, $S_{h}{}^{1st}{}_{k,m}$ denotes similarities between the first similar face images and the face images m of the image DB, $S_{h}{}^{1st}{}_{k,h}{}^{2nd}{}_{l}$ denotes similarities between the first

similar face images and the second similar face images, $S_h^{2nd}{}_{l,m}$ denotes similarities between the second similar face images and the face images m of the image DB, M denotes a number of the first similar face images, and L denotes a number of the second similar face images with respect to each of the second similar face images.